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FRDA Research Memo

October 1989 | Vegetation Management | No. 116

Characterization of Light Microenvironments and Competition in Mixed-shrub Communities in the Interior Cedar Hemlock Zone – Project No. 3.48

Mixed shrub communities dominate many clearcuts in cool moist portions of the southern interior. The following plants commonly make up the largest portion of these communities: thimbleberry (*Rubus parviflorus*), raspberry (*Rubus idaeus*), elderberry (*Sambucus* spp.), fireweed (*Epilobium angustifolium*), bracken fern (*Pteridium aquilinum*), lady fern (*Athyrium filix-femina*).

Like other plants, conifers use light energy for photosynthesis and growth. When conifer seedlings are overtopped by vegetation, the amount of light which they receive is reduced; their photosynthesis and growth may also be reduced. Mixed shrub communities also influence conifer growth through competition for water and nutrients, or by causing physical damage to seedlings through litterfall, press, and whipping.

The penetration of light through mixed shrub communities and the effects of varying levels of vegetation cover on spruce seedling growth in the Interior Cedar Hemlock Zone are being examined in FRDA Project 3.48.

The project has three objectives:

1. **To characterize the effects of mixed-shrub communities on the amount of light available to conifer seedlings.**
2. **To measure seedling growth and physiological responses to varying levels of competition in these communities.**
3. **To develop and evaluate operational procedures for assessing aboveground competition in these communities.**

The amount of light penetrating canopies of non-crop vegetation and its relationship to vegetation cover and height was measured during 1987 and 1988 in sample plots located on several sites in the Arrow and Kootenay Lake Forest Districts. As total vegetation cover increased, the amount of light penetrating the canopy declined (Figure 1). From estimates of percent cover of overtopping vegetation, the relationship shown in Figure 1 can be used to calculate the amount of light reaching crop seedlings and the amount of aboveground competition to which they are exposed.

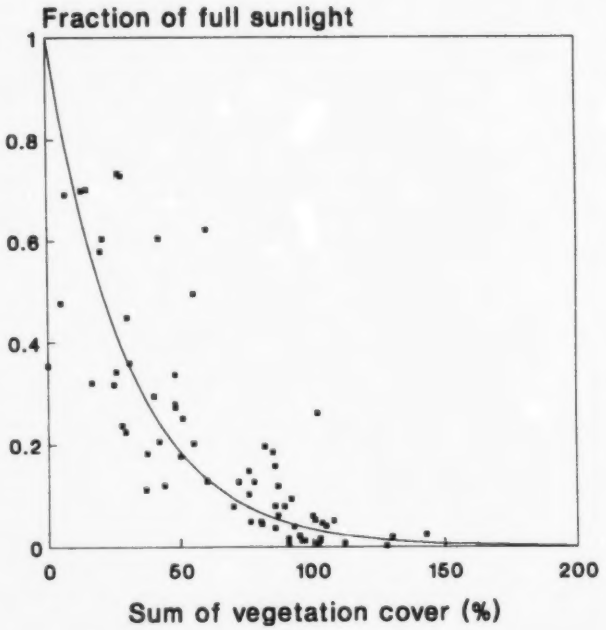

FIGURE 1. The fraction of full sunlight penetrating the vegetation canopy decreases as total vegetation cover increases. (Total vegetation cover equals the sum of percent cover of each non-crop species occurring within a 5 m^2 plot centered around the crop seedling.)

Estimated effects of vegetation cover on seedling photosynthesis are shown in Figure 2. As vegetation cover increases and the amount of light reaching seedlings is reduced, the rate of net photosynthesis of the overtopped Engelmann spruce declines.

Field data on vegetation cover, light reductions, photosynthesis, growth, and survival of Engelmann spruce seedlings are being collected from five study sites in the Arrow Forest District. Additional study sites are being established in Revelstoke and Golden Districts during 1989.

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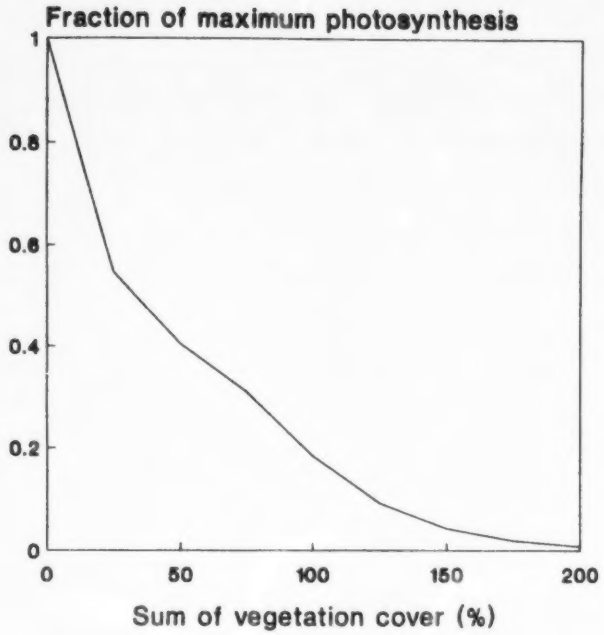

FIGURE 2. As vegetation cover increases, the rate of net photosynthesis of overtopped Engelmann spruce seedlings declines. Estimates of rates of photosynthesis for Engelmann spruce were calculated using the light attenuation curve shown in Figure 1 and published information on relationships between photosynthesis and irradiance for Engelmann spruce seedlings.

The first year seedling measurements show that variation in 1988 height growth of spruce seedlings was related to seedling crown length and vegetation cover (Figure 3). For a seedling of any given crown length, height growth decreases as vegetation cover increases. As seedling crown length and leaf area increase, seedling growth also increases.

The seedlings in this study have responded to only one or two years of competition from overtopping vegetation. Consequently, the observed effects of vegetation cover on 1988 height growth were relatively small. Height increment was also less sensitive to the effects of competing vegetation than diameter increment. Effects of non-crop vegetation on diameter and volume increment of spruce seedlings will be examined following remeasurement of seedlings in 1989 and subsequent years.

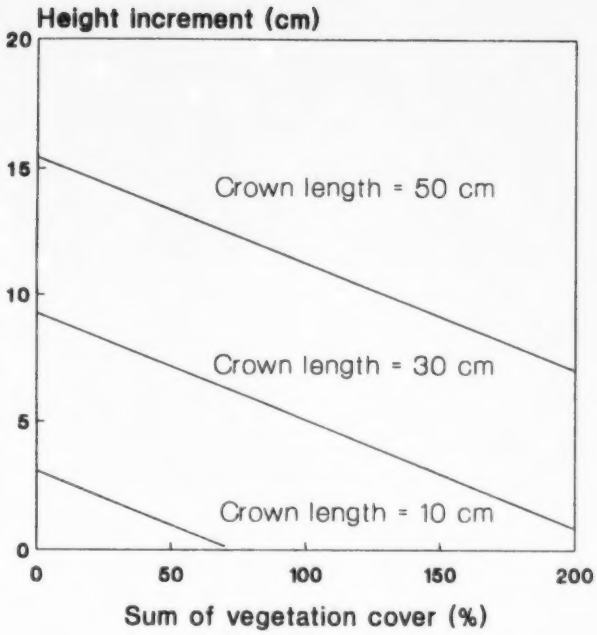

FIGURE 3. Height increment of Engelmann spruce seedlings is related to vegetation cover and seedling crown length. Lines are shown to illustrate trends observed for seedlings with crown length equalling 10, 30, and 50 cm.

The results of this study will be used in developing techniques to aid in the field assessment of competition from non-crop vegetation and to predict potential responsesof spruce seedlings to vegetation control treatments.

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